Small Business Innovation Research/Small Business Tech Transfer

>1,000 W/kg Rad-Hard, High-Voltage PV Blanket at < $50/W IMM Cell Cost, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

The innovation is a new type of Stretched Lens Array (SLA) with a much thinner, lighter and more robust Fresnel lens than prior versions. The new lens enables a full blanket-level specific power > 1,000 W/kg, including lenses, the complete PV cell circuit (including cells, encapsulation, high-voltage insulation, and heavy radiation shielding), and waste heat rejection radiator. The new SLA array is cost-effective, with the most expensive array cost element, the IMM solar cell, contributing less than $50/W to the array cost. The new lens is novel in configuration, enabling single-axis tracking for the array even in the presence of large beta angles (e.g., 50 degrees) between the array and the sun. For future high-power arrays (e.g., > 100 kW), including Solar Electric Propulsion (SEP) missions, the new SLA will offer a unique combination of high efficiency (e.g., >35%), ultra-low mass, high-operating voltage (e.g., >300 V), and low cost. SLA technology is a direct descendant of the SCARLET array used to power NASA's Deep Space 1 SEP mission in 1998-2001. SLA recently completed a flight test on TacSat 4 in a very high radiation orbit, and the lessons learned from TacSat 4 led to the new SLA, the subject of this proposal. The new SLA is scalable to multi-hundred-kW array sizes using blanket deployment and support platforms such as DSS's Roll-Out Solar Array (ROSA) or ATK's SquareRigger. The new SLA will typically operate at 4-8X concentration, saving substantially on solar cell area, cost, radiation shielding mass, and dielectric isolation mass. The new SLA will enable the early use of state-of-the-art cells, such as inverted metamorphic (IMM) cells with 4 or 6 junctions, and will enhance the production capacity of cell vendors (e.g., 100 kW per year of 1 sun cells = 700 kW per year of 7X cells). The feasibility of the new SLA will be firmly established in Phase I, and functional prototype new SLA hardware will be fully developed and tested in Phase II.

>1,000 W/kg Rad-Hard, High-Voltage PV Blanket at < $50/W IMM Cell Cost, Phase I

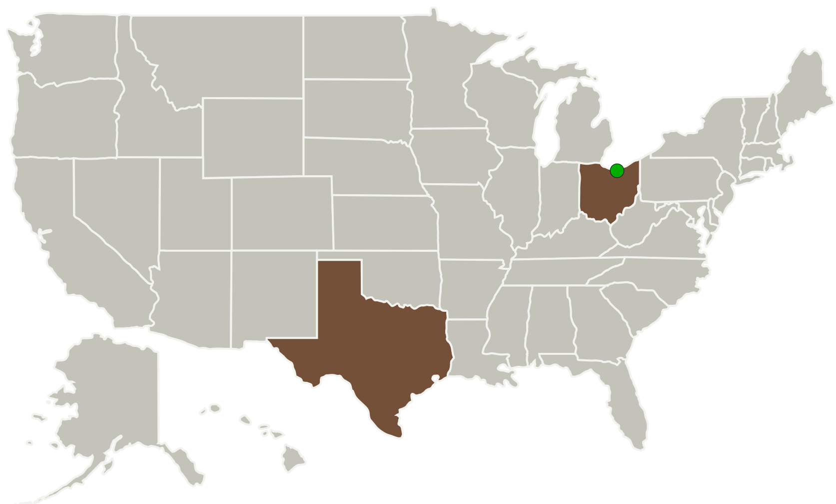
Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

>1,000 W/kg Rad-Hard, High-Voltage PV Blanket at < $50/W IMM Cell Cost, Phase I

Completed Technology Project (2014 - 2014)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Mark O'Neill, LLC	Lead Organization	Industry	Keller, Texas
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Texas

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/140613)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Mark O'Neill, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

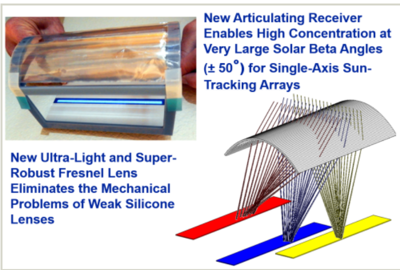
Principal Investigator:

Mark O'neill

Co-Investigator:

Mark O'neill

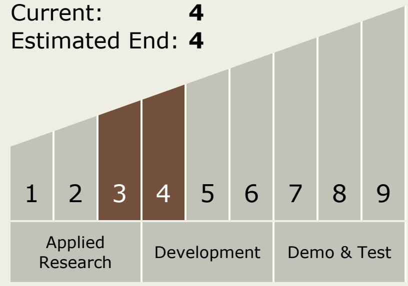
Images



Briefing Chart
>1,000 W/kg Rad-Hard, High-Voltage PV Blanket at < $50/W IMM Cell Cost, Phase I
(https://techport.nasa.gov/image/137190)

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  └ TX03.1 Power Generation and Energy Conversion
    └ TX03.1.1 Photovoltaic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System